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ABSTRACT

Research in the field of computer based instruction (CBI) has led to conflicting evidence on the efficacy of learner control over instruction. Typical implementations of learner control in CBI allow learners to proceed at their own pace, control the sequence of instruction, choose the amount of practice, or decide the level of difficulty attempted. Benefits of learner control have primarily been in the affective domain, with students spending more time on the task when given control over their own instruction. Results in achievement have been mixed, however, when the learner is allowed control over the amount and sequence of instruction. Recent studies allowing the learner to manipulate contextual variables such as text density have demonstrated learner control to be a viable option in CBI. The implication arises that those variables which do not manipulate the amount of content support are those over which the learner should be allowed control. This paper provides a model for classifying the various learner control variables and suggests recommendations for implementing these variables in CBI software and research. (17 references) (Author/EW)

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Perspectives On Implementation Of Learner Control in CBI

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Abstract

Research in the field of computer-based instruction has led to conflicting evidence of the efficacy of learner control over instruction. Typical implementations of learner control in CBI allow learners to proceed at their own pace, control the sequence of instruction, choose the amount of practice, or decide the level of difficulty attempted. Benefits of learner control have primarily been in the affective domain, with students spending more time on task given control over their own instruction. Results have been mixed, however, in achievement when the learner is allowed control over the amount and sequence of instruction. Recent research studies allowing the learner to manipulate contextual variables such as text density have demonstrated learner control to be a viable option in CBI. The implication arises that those variables which do not manipulate the amount of content support are those over which the learner should be allowed control. This paper provides a model for classifying the various learner control variables and suggests recommendations for implementing these variables in CBI software and research.

In 1957 Russian scientists astounded the world by successfully orbiting an artificial satellite which they named Sputnik and galvanized Western society into a unified effort to improve our schools. Since 1957, educators have been subjected to continued pressure not only to improve the quality of our schools but also to educate a broader segment of society. One response to this pressure was the development of systems for individual instruction based on Skinner's theory of behaviorism (1938) and Bloom's (1971) theory of mastery learning. Instructional systems from Programmed Instruction to computer-based instruction have been designed to individualize instruction.

Carrier (1984) observes that no other delivery system except the teacher equals the computer in its potential ability to accommodate the needs of individual learners. The use of computers in education has finally made individualization a feasible goal. In designing individual instruction the question has become to what extent learners control their own instruction rather than submit to computer control. This paper intends to discuss learner control and to propose a classification scheme of the research.

Learner control. Before we can categorize research in learner control we must have a working definition of the term itself. There has been considerable debate over what

constitutes control, from allowing the student to make decisions over a single aspect of instruction to almost complete control over a whole course of study. According to McCann (1981) the issue has been reduced to an "all or none" proposition. He points out, however, that education itself progresses from the kindergarten with scarcely any learner control to graduate school where learner control of study predominates. In the broadest sense, therefore, we can define learner control as student decision-making. Student decision-making in strategy, sequence, pace, amount of practice, and level of difficulty have all been investigated.

Sequence. Judd, Bunderson, and Bessent (1970) studied the effects of four levels of learner control in a remedial mathematics course for college students: (1) computer control; (2) learner control over sequence; (3) student control over amount of practice; and (4) complete learner control. They found that students who had done poorly on pretests performed worse under learner control. They also noted that when students were allowed control of sequence some topics were omitted which might have been crucial to understanding. Further, students did more poorly with complete control over their own instruction than those who were under complete computer control. In utilizing the

TICCIT system, which allows student control of course flow, Bunderson (1976) found that there was no difference in overall achievement between these students and those in regular classrooms. He pointed out, however, that some students make poor strategy choices when left with no instructional advice. TICCIT is reported as a learner control system, with program mechanisms to allow the student to select and sequence content. One of TICCIT's designers stated (Merrill,1979) that if he were designing a second version he would include more help for the student to know how to proceed. Using the PLATO system, Lahey, Crawford, and Hurlock (1975) also found that there was no significant difference in performance between students who had control over flow and those who did not, although the learner control group spent more time on task than the autonomous group even though both groups were self-paced. Seidel, Wagner, Rosenblatt, Hillelsohn, and Stelzer (1978) found that not all students used good learning strategies when given control of sequencing in a programming course in Cobol. Jacobson and Thompson (1975) interpreted learner control as student self-teaching, and as such proposed a sort of "teacher training" for students in order to maximize their strategy decisions. Derry (1984) also investigated strategies training in preparing students for control of

instruction. She concluded that no single instructional device is known that will greatly enhance learning effectiveness, with the possible exceptions of what she termed "forced practice" and feedback.

Pacing. Another aspect of investigation in learner control has been the pace of presentation of material. Even in this area there has not been clear consensus. Gay (1986) found that high aptitude students performed better than low aptitude students when given control over pace. Goetzfried and Hannafin (1985), however, found no differences in achievement among students in treatments: (1) adaptive control (external based on accuracy of response); (2) learner control with advisement; and (3) linear control (no control except over pace). The conclusion then would be that if there is no difference in achievement the treatment of choice would be that which took less time, the linear control treatment. One area of interest in research on pace of instruction is student procrastination. Reiser (1984) studied the effects of three pacing procedures: (1) rewards for completing on time; (2) penalty for tardy completion; and (3) learner control of pacing. He found that there was no difference in achievement among the groups, but that the learner control group only met 22.2% of deadlines compared to 61.6% met by the penalty group and 43.8% by the reward

group. There was no significant difference in attitudes concerning the course or in withdrawal rate.

Instructional support. If we can find no consensus for sequencing or pacing, there is some agreement over student control of number of examples. Again, studies show no significant differences in achievement among groups who have varying amounts of control over examples given (Gay, 1986; Axtell, 1978; Wilcox, Richards, Merrill, Christensen, & Rosenvall, 1978). Wilcox and associates (1978) assigned college students learning logarithms using the TICCIT system to either a learner control group, with choice in the number of examples, or to a "yoked" group. Students assigned to this group were randomly paired with students in the learner control group and required to study the same number of examples as their counterparts in the learner control group. Since there were no differences in posttest performance of the two groups, Wilcox maintained that there was no evidence that learner control of number of examples would accommodate individual differences. Carrier and associates (1985), however, found that high ability students did better with options for the number of examples than did low ability students. Amount of practice was another variable studied along with number of examples. Judd (1981) found that learner control resulted in subjects studying fewer practice

modules, but that posttest scores did not differ from those students who had no such control. Learner control of the number of practice examples was found to be an ineffective strategy by Ross and Rakow (1981) when compared to subjects who had adaptive program control of instruction. Montanelli and Steinberg (cited in Steinberg, 1977) found that students in a computer science lesson followed practice suggestions on easy problems but ignored practice suggestions with problems on more difficult concepts.

A premise of much of the research on learner control has been that students in control of their own learning are better motivated than their counterparts with no such control. No differences in attitude were found among treatment groups by Lahey (1978). Students responding to informal questioning by Ross and Rakow (1981), however, reported positive attitude responses to learner control. Salomon (1985) contends that learning depends on the learner's "mindfulness", which in turn depends on expectations, perceptions, attitudes, and goals. Mindfulness then is a volitional matter, the importance of which increases the more control over the learning process students are given.

Because of the lack of consensus on many of the aspects of learner control research and contradictory results found

in various studies it is not possible to pronounce judgement on the entire concept of learner control of instruction. Several trends, however, can be deduced. Originally, designers of instruction interpreted learner control as the opportunity for students to sequence content in a particular course of instruction and to control pace. Increase in time on task was considered a price one paid for supposedly positive effects in the affective domain. Later research has emphasized learner control of strategies of instruction, but many researchers are hypothesizing that students do not have the metacognitive skills to utilize the most effective strategies. Indeed, the entire concept of advisement (Johansen and Tennyson,1983; Mullen, 1984) is predicated on the idea that students need help in devising learning strategies. Results that indicate better results from high ability students (Carrier et al., 1985) suggests that these same students have the necessary metacognitive skills already in place and that their superior performance is a result of this acquisition of skills rather than control of instruction. As an alternative approach in research, therefore, it is suggested that variables less sensitive to lack of metacognitive strategies be investigated.

Context. One such area with potential for research would be learner control over the context in which examples

are presented. Anand and Ross (1987) studied the use of personalized word problems in mathematics for fifth- and sixth-grade children. Problem contexts were varied by altering the referents and background themes of example problems while keeping the numerical values and measurement units constant. Abstract contexts involved the use of general referents in problem statements (e.g., quantity, fluid, liquid). Concrete contexts used specific standard referents (e.g., Mary, English, a teacher) to convey realistic but hypothetical applications. Personalized contexts used personally familiar items obtained from biographical questionnaires. Findings indicate the personalized materials to be beneficial across a variety of learning outcomes as well as for attitudes toward the task. Based on the idea that older students appear to have strong individual preferences for general themes (e.g.,education, nursing, business) (Ross, McCormack, & Krisack, 1986), a study allowing college students control of background theme in a statistics lesson (Ross, Morrison, and O'Dell, 1988) indicated that students pick a variety of themes instead of staying with only one theme throughout the lesson. They reported most subjects varied their selections across lessons, suggesting some attempt by subjects to adjust strategies as perceived needs changed. Another contextual

variable of CBI over which the learner could exercise control is the text density level of the material presented. Morrison, Ross, and O'Dell (1988) presented the narrative text of a statistics lesson containing low-density (concise) text, high-density (conventional) text, or learner-controlled density level. Each version contained the same information, but the low-density version eliminated details and nonessential words, resulting in an approximately 50% reduction in both number of words and screen area required. Findings imply adaptive uses of learner control and, as such, "...reinforce the idea that learner control is not a unitary concept, but rather a collection of strategies that work in different ways depending on what is being controlled by whom " (Morrison, Ross, O'Dell, & Schultz, 1988,p.73). In these ways students maintain control of contextual variables with instructional support controlled by the program. Thus, students can exercise control over how they want to learn, with its accompanying affective benefits, while following a lesson prepared by the professional designer who maintains control over the amount of instructional support the student needs.

Summary

Early research on learner control focused on content variables. Pacing left to learner control has been found ineffective because learners tend to procrastinate or to exit lessons prematurely. Sequence, or content flow, has been an ineffective variable left under student control since appropriate sequencing of the lesson requires prior knowledge of content. Number of examples and level of difficulty are also inappropriate decisions for the learner to make because students frequently lack metacognitive skills to make such strategic decisions. Advisement strategies have attempted successfully a diagnostic/ prescriptive approach to control of content variables. Current research, however, has focused on contextual variables under control of the learner. Variables such as text density level and background theme have allowed learner control of stylistic qualities of the lesson without sacrificing instructional support. Future research of learner control in CBI, therefore, should concentrate on the continuum of contextual variables with their accompanying affective benefits rather than content variables with their inherent disadvantages and implicit "all or none" philosophy.

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